

(19) World Intellectual Property Organization  
International Bureau



(43) International Publication Date  
4 April 2002 (04.04.2002)

PCT

(10) International Publication Number  
**WO 02/26432 A1**

(51) International Patent Classification<sup>7</sup>: **B23F 21/23**

(21) International Application Number: PCT/US01/42397

(22) International Filing Date:  
28 September 2001 (28.09.2001)

(25) Filing Language: English

(26) Publication Language: English

(30) Priority Data:  
09/672,917 28 September 2000 (28.09.2000) US

(71) Applicant (for all designated States except US): **INLAND  
DIAMOND PRODUCTS COMPANY** [US/US]; 32051  
Howard Street, Madison Heights, MI 48071-1473 (US).

(72) Inventor; and

(75) Inventor/Applicant (for US only): **RAFFAELLI, Dennis,  
R.** [US/US]; 1951 Royal Birkdale Drive, Oxford, MI 48371  
(US).

(74) Agent: **WARN, Philip, R.**; Warn, Burgess & Hoffmann,  
P.C., Suite B125, 691 North Squirrel Road, Auburn Hills,  
MI 48326 (US).

(81) Designated States (national): AE, AG, AL, AM, AT, AU,  
AZ, BA, BB, BG, BR, BY, BZ, CA, CH, CN, CO, CR, CU,  
CZ, DE, DK, DM, DZ, EC, EE, ES, FI, GB, GD, GE, GH,  
GM, HR, HU, ID, IL, IN, IS, JP, KE, KG, KP, KR, KZ, LC,  
LK, LR, LS, LT, LU, LV, MA, MD, MG, MK, MN, MW,  
MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE, SG, SI,

SK, SL, TJ, TM, TR, TT, TZ, UA, UG, US, UZ, VN, YU,  
ZA, ZW.

(84) Designated States (regional): ARIPO patent (GH, GM,  
KE, LS, MW, MZ, SD, SL, SZ, TZ, UG, ZW), Eurasian  
patent (AM, AZ, BY, KG, KZ, MD, RU, TJ, TM), European  
patent (AT, BE, CH, CY, DE, DK, ES, FI, FR, GB, GR, IE,  
IT, LU, MC, NL, PT, SE, TR), OAPI patent (BF, BJ, CF,  
CG, CI, CM, GA, GN, GQ, GW, ML, MR, NI, SN, TD,  
TG).

**Declarations under Rule 4.17:**

— as to applicant's entitlement to apply for and be granted  
a patent (Rule 4.17(ii)) for the following designations AE,  
AG, AL, AM, AT, AU, AZ, BA, BB, BG, BR, BY, BZ, CA, CH,  
CN, CO, CR, CU, CZ, DE, DK, DM, DZ, EC, EE, ES, FI,  
GB, GD, GE, GH, GM, HR, HU, ID, IL, IN, IS, JP, KE, KG,  
KP, KR, KZ, LC, LK, LR, LS, LT, LU, LV, MA, MD, MG, MK,  
MN, MW, MX, MZ, NO, NZ, PH, PL, PT, RO, RU, SD, SE,  
SG, SI, SK, SL, TJ, TM, TR, TT, TZ, UA, UG, UZ, VN, YU,  
ZA, ZW, ARIPO patent (GH, GM, KE, LS, MW, MZ, SD, SL,  
SZ, TZ, UG, ZW), Eurasian patent (AM, AZ, BY, KG, KZ,  
MD, RU, TJ, TM), European patent (AT, BE, CH, CY, DE,  
DK, ES, FI, FR, GB, GR, IE, IT, LU, MC, NL, PT, SE, TR),  
OAPI patent (BF, BJ, CF, CG, CI, CM, GA, GN, GQ, GW,  
ML, MR, NE, SN, TD, TG)

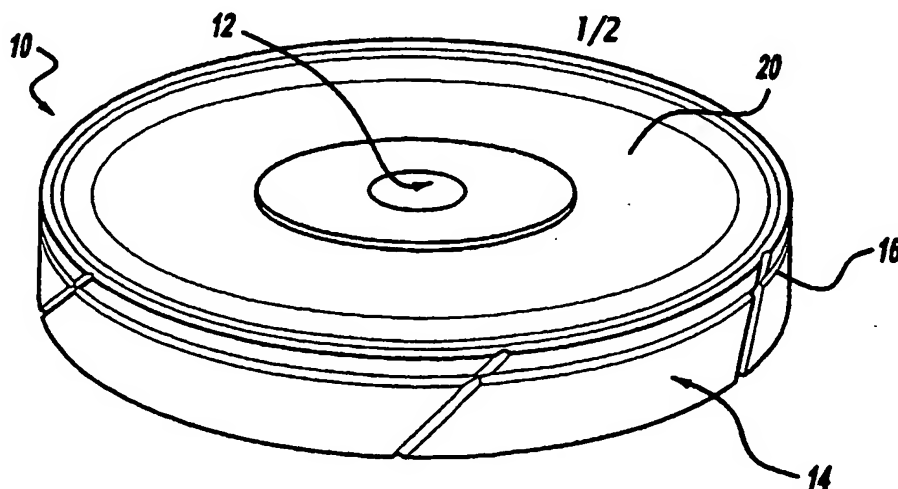
— as to the applicant's entitlement to claim the priority of the  
earlier application (Rule 4.17(iii)) for all designations

**Published:**

— with international search report

[Continued on next page]

(54) Title: BEVEL EDGING WHEEL WITH SWarf CLEARANCE



(57) Abstract: A bevel edge wheel (10) having a swarf clearance slot (18) across the shaping face. The slot reduces the amount of hand removal of swarf from a processed lens blank.

WO 02/26432 A1



-- before the expiration of the time limit for amending the claims and to be republished in the event of receipt of amendments

For two-letter codes and other abbreviations, refer to the "Guidance Notes on Codes and Abbreviations" appearing at the beginning of each regular issue of the PCT Gazette.

## BEVEL EDGING WHEEL WITH SWARF CLEARANCE

5

### Technical Field

The present invention relates to a bevel edging wheel of the type used for edging of an optical edge. More specifically, the present invention relates to a bevel edging wheel which reduces the necessary manual removal of swarf from the lens after edging of an optical lens.

### Background of the Invention

Optical lenses made of polycarbonates, high index and CR39 materials are known in the art. In order to finish and make these lenses ready for fitting into a lens frame, it is necessary to bevel edge the outer periphery of the lens, to give it the proper cross-section to fit in an eye glass lens frame. Typically, this is done by a bevel edging machine, which includes a rough cut wheel for cutting out the shape and a bevel edging wheel for providing the final contour. Depending on the lens material, the grinding operation creates abrasive swarf material which requires removal in order for proper use of any type of abrasive device. Typically, the wheels have build up of swarf during the operation, which imparts itself onto the lens. This creates the need to manually remove the swarf from the lens. Any swarf which is not readily removed during the grinding of the bevel edging operation, interferes with the operation and, at the very least, slows it down and may add to several hand finishing steps necessary at the end, or an improper bevel configuration.

In the optical industry today, the one hour optical labs and the like have made it necessary for increased any improved efficiencies are desirable in the process.

Therefore, it is desired to eliminate swarf removal on the polycarbonate lens by hand, which is labor intensive and time consuming.

Therefore, it is a goal in the art to provide a bevel edging wheel which eliminates the need for manual swarf removal.

5

### **Summary of the Invention**

In accordance with the present invention, there is provided a bevel ending wheel for edge finishing of an optical lens blank. The lens comprises a hub portion which is adapted for attachment to a rotary power source. The wheel includes an  
10 outer circumferential cutting surface having a width. The outer circumferential cutting surface includes an abrasive grit attached thereto and also has a circumferential groove therein for forming an edge contour onto an optical lens. The wheel includes a radially extending planar side portion, and in a preferred embodiment, has at least one swarf clearing groove extending at an angle to said  
15 side portion across the circumferential groove and opening into the planar side portion, which allows removal of swarf out through the planar side portion.

A further understanding of the present invention will be had in view of the description of the drawings and detailed description of the invention, when viewed in conjunction with the subjoined claims.

20

### **Brief Description of the Drawings**

Figure 1 is a perspective view of the bevel edging wheel of the present invention;

Figure 2 is a plan view of the bevel edging wheel of the present invention;

25 Figure 3 is a top view of the bevel edging wheel of the present invention;

Figure 4 is a sectional side view taken along line 4-4 of Figure 2; and

Figure 5 is a detailed side view showing the swarf clearing groove of the present invention.

## 5 Detailed Description of the Preferred Embodiments

In accordance with the present invention, there is provided a rotary edging wheel generally shown at 10 for edge finishing of an optical lens. The bevel edge wheel of the present invention includes a hub portion generally indicated at 12 and an outer circumferential cutting surface generally indicated at 14.

10 Referring now to Figures 2-4, an outer circumferential cutting surface includes a width W and has a circumferential groove 16 formed therein. Abrasive grit material is attached to the outer surface 14 and within the groove 16 for cutting of the lens. The wheel of the present invention includes at least one swarf clearing groove 18 which extends at least through the groove 16 to an outer planar surface of the wheel  
15 20 or 22. The swarf clearing groove extends to the outer planar surface for removal or swarf during cutting of the lens.

In a preferred embodiment, the angle of the swarf clearing groove 18 may be 40 degrees from a side wall. Generally, the groove would be angled from about 10 degrees to about 80 degrees in relation to the side wall 20. Typically, the groove is  
20 formed at an angle of about 15 degrees to about 65 degrees, and preferably from about 35 degrees to about 45 degrees. In a preferred embodiment, the groove extends along the entire width of the wheel W. However, it will be readily appreciated that it is only necessary to run the groove from the bevel edge forming portion of the wheel to the exterior of the wheel, such that swarf can be removed  
25 along the groove.

Referring to Figure 5, the groove 18 has planar sides 24 and 26 which extend perpendicular to outer surface 14. In a preferred embodiment, a 1/8" wide and .060" deep slot is formed in the wheel, generally from 20 degrees to 80 degrees slot angles, and preferably 40 degrees to 70 degrees, with 60 degrees preferred. While at least one of the slots is necessary, preferably a plurality of slots is utilized which are equiangular spaced around the outer periphery. Generally, from greater than 1 to about 20 slots are used, and preferably 4 to about 8, with 6 being preferred.

Bevel edging wheels made in accordance with the present invention are readily used in bevel edging machines such as those made by Weco, Colburn or the like. Such machines are readily known to those skilled in the art, as well as their operation. While bevel grooves are disclosed, the wheel of the present invention can be used without a bevel groove such as in a rimless flat style wheel.

The cross-section of the beveling groove may be any of the desirable cross-sections for use of the lens in a glass frame of those known in the art. Typically, it is an angled section of about 105 degrees, as shown in the drawings. However, other configurations may be readily adapted to the present invention. Typically, the abrasive grits used in the present invention are from about 5-10 microns to about 100-120 mesh. Preferably, the grits are attached by brazing the abrasive grit onto the wheel. However, the grit surface may also be attached by sintering electroplating or resin bonding, with a preferred abrasive grit material being a diamond-like hardness abrasive grit. However, other materials such as silicon carbides, tungsten carbides, oxides, garnets, cubic boron nitride, and natural and synthetic diamonds may be used alone or in combination in the present invention. It has been found that the wheel of the present invention eliminates about 90 percent of the swarf from the edge of polycarbonate, high index and CR39 lens materials.

Those skilled in the art can now appreciate from the foregoing description that the broad teachings of the present invention can be implemented in a variety of forms. Therefore, while this invention has been described in connection with particular examples thereof, the true scope of the invention should not be so limited, 5 since other modifications will become apparent to the skilled practitioner upon a study of the drawings, specification and following claims.

**Claims**

1. A rotary edging wheel for edge finishing of an optical lens comprising:  
a hub portion adapted for attachment to a rotary power source;  
an outer circumferential cutting surface having a width, said surface including  
5 an abrasive grit attached thereto;  
a radially extending planar side portion;  
at least one swarf clearing groove extending at an angle at least across a part  
of said surface; and  
an opening into said planar side for removal of swarf out through said planar  
10 side.
2. The bevel edging wheel of claim 1 further comprising a plurality of said  
swarf clearing slots formed in said circumferential cutting surface.
- 15 3. The bevel edging wheel of claim 1 wherein said swarf clearing slot  
extends along a portion of the cutting surface.
4. The bevel edging wheel of claim 1 wherein said swarf clearing slot  
extends along the entire length of said cutting surface.
- 20 5. The bevel edging wheel of claim 1 wherein said slot has an angle of  
from about 10 degrees to about 80 degrees.
6. The bevel edging wheel of claim 1 wherein said slot has an angle of  
25 from about 15 degrees to about 65 degrees.



7. The bevel edging wheel of claim 1 wherein said slot has an angle of from about 35 degrees to about 45 degrees.

5 8. The bevel edging wheel of claim 1 wherein the abrasive grit is attached to the wheel by brazing, electroplating, sintering or resin bonding.

9. The bevel edging wheel of claim 8 wherein said abrasive grit is a diamond hardness grit.

10

10. A rotary bevel edging wheel for edge finishing of an optical lens comprising:

a hub portion adapted for attachment to a rotary power source;

an outer circumferential cutting surface having a width, said surface including

15 an abrasive grit attached thereto, and having a circumferential groove therein for forming an edge contour onto an optical lens;

a radially extending planar side portion;

a plurality of at least one swarf clearing grooves extending at an angle at least across said circumferential groove; and

20 an opening into said planar side for removal of swarf out through said planar side.

11. The bevel edging wheel of claim 10 wherein said swarf clearing slot extends along the entire length of said cutting surface.

25

12. The bevel edging wheel of claim 10 wherein said slot has an angle of from about 10 degrees to about 80 degrees.

13. The bevel edging wheel of claim 10 wherein said slot has an angle of  
5 from about 15 degrees to about 65 degrees.

14. The bevel edging wheel of claim 10 wherein said slot has an angle of from about 35 degrees to about 45 degrees.

10 15. The bevel edging wheel of claim 10 wherein the abrasive grit is attached to the wheel by brazing, electroplating, sintering or resin bonding.

16. The bevel edging wheel of claim 15 wherein said abrasive grit is a diamond hardness grit.

15

17. A rotary bevel edging wheel for edge finishing of an optical lens comprising:

a hub portion adapted for attachment to a rotary power source;

an outer circumferential cutting surface having a width, said surface including  
20 an abrasive grit attached thereto, and having a circumferential groove therein for forming an edge contour onto an optical lens;

a radially extending planar side portion;

a plurality of swarf clearing grooves extending across the width of said outer circumferential cutting surface, at an angle of from about 35 to about 45 degrees to  
25 said planar side portion; and

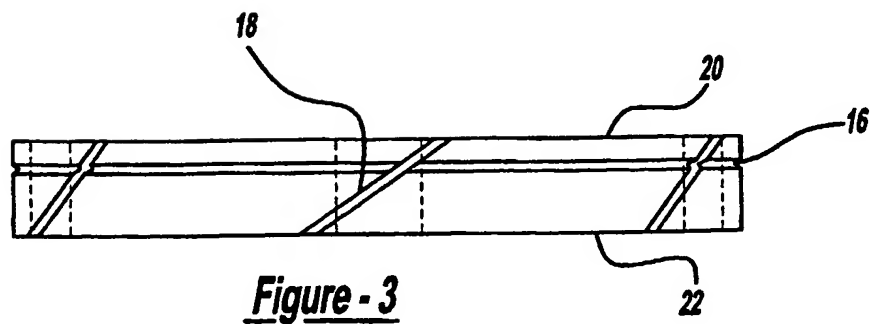
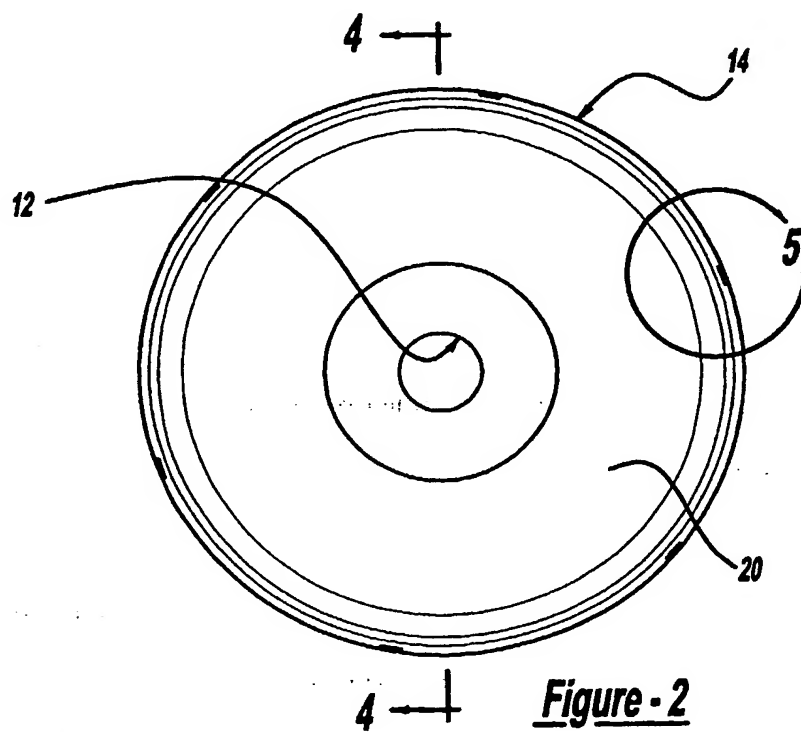
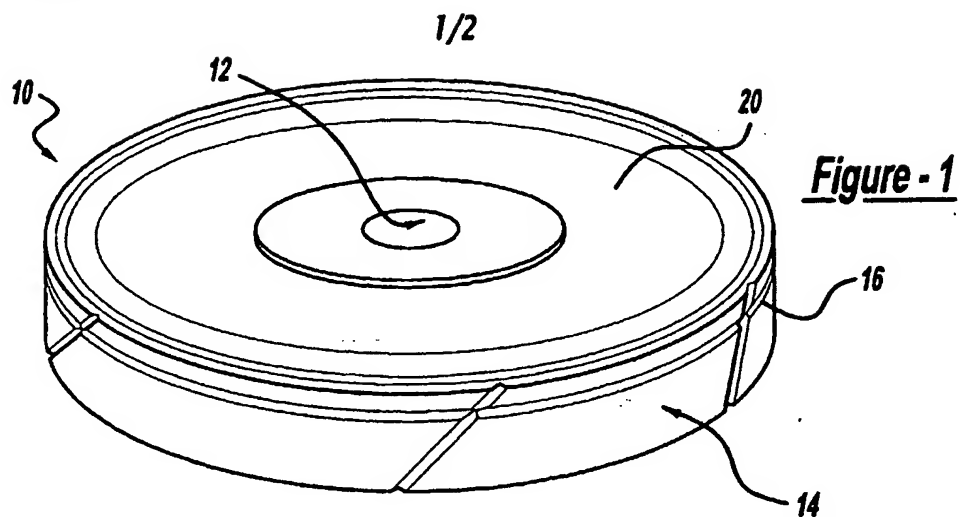
an opening into said planar side for removal of swarf out through said planar.

18. The bevel edging wheel of claim 17 wherein the abrasive grit is attached to the wheel by brazing, electroplating, sintering or resin bonding.

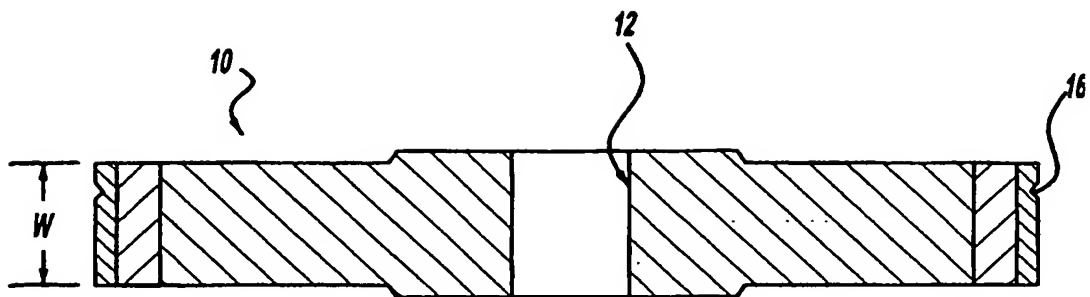
5

19. The bevel edging wheel of claim 18 wherein said abrasive grit is a diamond hardness abrasive grit.

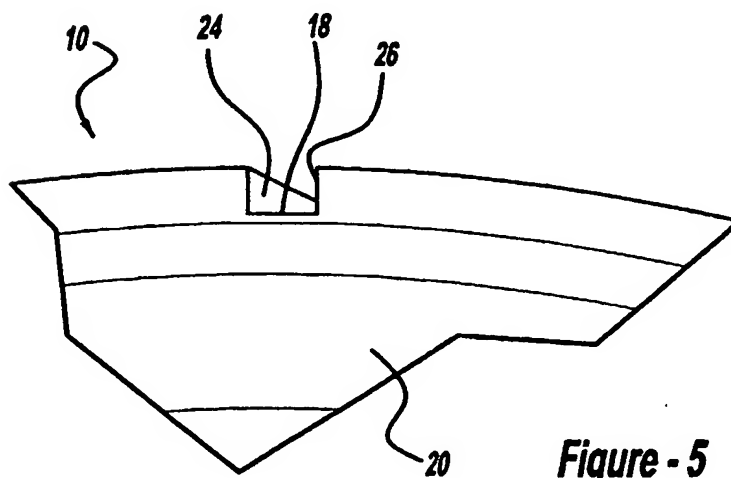
20. The bevel edging wheel of claim 17, wherein said abrasive grit is a  
10 diamond grit material having a mesh of from about 5-10 microns to about 100-120 mesh.



SUBSTITUTE SHEET (RULE 26)



**Figure - 4**



**Figure - 5**

# INTERNATIONAL SEARCH REPORT

International application No.  
PCT/US01/42397

## A. CLASSIFICATION OF SUBJECT MATTER

IPC(7) : B23F 21/23

US CL : 451/541, 547

According to International Patent Classification (IPC) or to both national classification and IPC

## B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

U.S. : 451/541, 547

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practicable, search terms used)

## C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	US 5,655,958 A ( <i>LUPI</i> ) 12 August 1997, See figures 1-4	1-20
A	US 5,997,597 A ( <i>HAGAN</i> ) 07 December 1999, See figures 1-11	1-20

☐ Further documents are listed in the continuation of Box C. ☐ See patent family annex.

+	Special categories of cited documents:	"I"	later document published after the international filing date or priority date and not in conflict with the application but cited to understand the principle or theory underlying the invention
"A"	document defining the general state of the art which is not considered to be of particular relevance	"X"	document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone
"E"	earlier document published on or after the international filing date	"Y"	document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art
"I"	document which may throw doubts on priority claim(s) or which is cited to establish the publication date of another citation or other special reason (as specified)	"8"	document member of the same patent family
"O"	document referring to an oral disclosure, use, exhibition or other means		
"P"	document published prior to the international filing date but later than the priority date claimed		

Date of the actual completion of the international search

30 DECEMBER 2001

Date of mailing of the international search report

25 JAN 2002

Name and mailing address of the ISA/US  
Commissioner of Patents and Trademarks  
Box PCT  
Washington, D.C. 20231

Facsimile No. (703) 305-3230

Authorized officer

JOSEPH HAIL

Telephone No. (703) 305-2687

*Sheila Verby*  
*Patent Specialist*  
*Technology Center 3700*

Form PCT/ISA/210 (second sheet) (July 1998)\*